

TP 7627E

PRELIMINARY EVALUATION OF THE ACCESSIBILITY OF THE ENSIGN EMPEROR COACH FOR DISABLED PERSONS



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TRANSPORTATION DEVELOPMENT CENTRE
TRANSPORT CANADA

PREPARED BY:

IBI
GROUP

IN ASSOCIATION WITH

B. CLARK ASSOCIATES LTD.

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THE ENSIGN EMPEROR COACH FOR DISABLED PERSONS

prepared for

Transportation Development Centre

by

CHARLES CLAPHAM
IBI Group

and

BRIAN CLARK
B. Clark Associates Ltd.

March 1986



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LANGUAGE NOTICE

Un sommaire en français de ce rapport est inclus avant la Table des matières.

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17. Abstract The objective of this study was to evaluate the technical and operational feasibility of converting the rear cabin of a double-decked bus to be accessible to disabled persons in wheelchairs. Five of twelve seats in the rear cabin of a double-decked Ensign Emperor coach were removed to provide space for two rearward facing persons in wheelchairs. Wheelchair access to the cabin was provided by a ramp that was light and simple to store. The wheelchairs were secured by straps which attached to track rigidly fastened to the cabin bulkhead (reinforced), to a seat frame and to the chassis through the floor. The ramp and securement system was inspected by professionals who treat disabled persons in wheelchairs and was tested by 21 wheelchair volunteers. The results were highly favourable, showing the desirability of some modifications to the conversion design, but proving it to be technically and economically feasible. The conversion would cost between \$1500 and \$3000 for a new bus, depending on the options selected. Such additional costs appear well justified to an operator in view of the potential additional market for his coach. An operational demonstration in commercial service is recommended.			
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17. Résumé L'étude dont il est rendu compte ici avait pour objet d'établir la faisabilité technico-économique de modifier le compartiment arrière d'un autocar à impériale et de l'adapter pour le transport de passagers en fauteuil roulant. Cinq des douze sièges occupant le compartiment arrière d'un autocar de marque Ensign Emperor à impériale ont été enlevés pour laisser la place à deux fauteuils roulants, placés à reculons. L'accès au compartiment s'est fait grâce à des rampes à la fois légères et aisées à ranger. Les fauteuils ont été ancrés au plancher par des sangles fixées à des rails verticaux, à un bâti de siège et à des rails fixés au plancher. Ces dispositifs d'embarquement et d'ancrage ont été inspectés par un personnel se spécialisant dans les soins aux personnes en fauteuil roulant, puis éprouvés par une vingtaine de volontaires en fauteuil roulant. Les résultats des essais, en plus d'être encourageants, ont montré que, à part quelques détails faciles à régler, le concept était techniquement et économiquement réalisable. Le coût des aménagements serait dans la fourchette des 1 500 à 3 000 \$ et se justifierait amplement au regard du marché accru auquel peut s'attendre un transporteur. Le rapport recommande le lancement d'un programme de démonstration en service payant du véhicule adapté.			
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The bus was supplied under contract by B. Clark Associates Ltd. Modifications were made by Western Bus Parts and Service Ltd.

Technical advice was provided by the following individuals and agencies:

Residents and Staff - Pearson Hospital

Residents and Staff - G.F. Strong Rehabilitation Centre

Staff - Canadian Paraplegic Association

Residents and Staff - False Creek Residence for the Disabled

Residents and Tour Organizer - Steeves Manor

Members - B.C. Coalition for the Disabled

EXECUTIVE SUMMARY

Introduction

The objective of this study was to investigate the technical and economic feasibility of modifying the rear cabin of a double-decked bus to provide ready access and seating for persons in wheelchairs or assisted from their wheelchairs to conventional seats for the journey.

The Ensign Emperor Coach has a rear compartment that is potentially suitable (through conversion) for accommodating disabled persons, with access by the rear passenger door using a manually positioned ramp. This coach has a main cabin with Vista dome observation windows to provide passengers with a viewing range greater than available on conventional intercity coaches due to the height of the main cabin deck. The coach also contains a lower level cabin with separate entry at the rear of the vehicle. This section accommodates twelve seated passengers with good viewing range through large side windows. This cabin is popular with passengers due to its comfortable, intimate atmosphere.

The Ensign Emperor Coach is custom-made in Europe for European Coach and Bus Inc. of Victoria, B.C. and is available for purchase by coach operators in North America. At present, the coach is the only one of its kind in Canada, but the use of a double-decked coach with a relatively low rear compartment may become more wide-spread, particularly if it offers easy access for wheelchairs. The Transportation Development Centre has been researching an advanced design high capacity bus (ADB) in recent years. Ramp access for wheelchairs could be provided in such a bus if the concept tested in this study is shown to be feasible.

System Design

Various configurations were considered for locating wheelchairs within the rear cabin. In Option A, five wheelchair locations would be provided, three of the them forward facing at the very rear of the bus and two of them backward facing and secured against the forward wall of the rear cabin. In Option B, only the two rearward facing locations would be provided, with the balance of the available seating being available for passengers assisted from their wheelchairs or for able-bodied passengers. In Option C, only the three forward facing locations would be provided, with the balance of the seats again being available for passengers assisted from their wheelchairs or for able-bodied passengers. For demonstration purposes, Option B was preferred since the wheelchairs would be in a safe and convenient location.

Access to the cabin was provided by a ramp which was light, inexpensive and simple to store. It was easy to use, since the height of the floor of the rear cabin was only 430 mm from the road and less than that when there was a curb.

Each wheelchair was secured in position by four straps which attached into a track similar to that used in aircraft to enable seats to be located into variable positions. The track was provided on the forward wall of the rear cabin and on the floor.

Test of the Conversion

The Ensign Emperor Coach was converted by Western Bus Parts and Services Ltd. of North Vancouver, B.C., on February 17 and 18, 1986. The conversion consisted of:

- construction of the ramps and receiving brackets
- removal of the appropriate seats
- attachment of the floor tracks
- provision of 8 belt systems (4 for each wheelchair position)

On February 19 the bus was taken to be inspected by residents and staff of two hospitals for the disabled and the staff of the Canadian Paraplegic Association. Individuals in these organizations reviewed the proposed arrangements and tested them as they considered appropriate using members of the study team or volunteers from their organizations. All the staff were supportive of the concept and welcomed the potential of such a system. Their comments on the desirability of Q-strait restraint systems, head-rests, accessible washrooms and door padding were noted. However, nothing unsafe was found from these inspections and no resultant coach modification was made.

On February 20 and 21, disabled volunteers from various organizations tested the system in various locations in Greater Vancouver. A total of 22 disabled persons tested the system, of whom 16 were taken for a drive which included hills and sharp curves. Each volunteer completed a questionnaire to indicate his views and comments on the ramp and securement systems.

Test Results

There were three significant findings from the tests:

- the ramp spacing needed to be wider; the access was inadequate for four of the wheelchairs, and for one of them, the door would not have been wide enough even if the ramp space had been sufficient.
- lap and shoulder belts of the Q-Strait type are desirable in addition to wheelchair securements.
- most wheelchair passengers preferred to transfer to coach seats rather than to travel in their own wheelchairs.

By providing wider brackets under the coach into which the hinged tongue of the ramp fitted, ramp spacing could easily be made variable and adequate for the widest or narrowest wheelchairs. It is recommended that this be done in any future modification. In new buses constructed for such use, it is also recommended that a door about 150 mm wider be used.

The CSA Standard CAN 3 - D409 - M84 specifies lap belts for wheelchair passenger restraint. Some operators recommend that passengers provide themselves with a Velcro-retained belt which holds the upper part of the body to the chair; others provide portable headrests which attach to the handles of most wheelchairs. However, three passengers commented on inadequate upper body restraint and a lap and shoulder belt of the Q-Strait type would be a desirable feature to include to restrain the passenger in his wheelchair. No passenger commented on the need for head protection, but the hospital professionals recommended it and suggested that a portable head rest attaching to the wheelchair arms may be a convenient way of doing this.

Market Acceptance

If done during the assembly of a new bus with a lower rear compartment of the Ensign Emperor Coach type, then conversion for handling wheelchair passengers who would be assisted into conventional seats in the rear compartment can be provided for approximately \$1,500. Such conversion would include ramps to enable wheelchairs to be taken into the rear cabin and hinging or collapsing mechanisms which would enable one pair of seats to be moved out of the way during the loading and unloading operations. This conversion would offer service equal to that supplied by the airlines, in which disabled passengers in transit are handled by transferring them to regular vehicle seats.

Equipping the coach with tracking and wheelchair securement and passenger restraint systems to permit two additional passengers to travel in their wheelchairs would bring the total conversion cost to less than \$3,000.

These costs may be put in perspective by noting that the Ensign Emperor Coach costs \$330,000 and contains \$2,000 worth of T.V. equipment, used for passenger entertainment during journeys. The coach rents for \$800 - \$1,000 per day. In deciding whether to purchase a coach with the optional extra features which permit disabled passengers to be carried, therefore, the operator may note that the cost of the ramp securement and restraint system is less than the income from three days coach rental. If the Ensign Emperor Coach appeals to him, it would appear very attractive for him to widen his market by including the option of wheelchair capability.

Individuals in the organizations who viewed the bus were very interested in its possibilities and inquired about its availability for rental. Given the number of persons in Canada who find it difficult or impossible to manage the stairs of a conventional intercity coach, there would appear to be a substantial market for the coach as converted in this experiment.

Conclusions and Recommendations

It is concluded that the costs of converting the lower rear cabins of double-decked coaches to enable them to carry wheelchair passengers are amply justified by the increased revenues likely to be generated by an operator. The ramps are simple and safe to use and the passenger is provided with a comfortable ride with a mixture of disabled/able-bodied individuals. The questions of whether to provide for wheelchair passengers or only those assisted from their wheelchairs to seats during transit and whether to provide washroom space in the rear compartment may be left to the discretion of the operator, but the case for providing for wheelchair passengers in some form is strong and clearly in the interests of the passengers and the operator.

It is recommended that a coach, converted in accordance with the recommendations contained in this report, be put into demonstration service and its use by both able-bodied and disabled passengers be monitored.

SOMMAIRE

Introduction

La présente étude avait pour objet d'établir la faisabilité technico-économique de modifier le compartiment arrière d'un autocar à impériale et de l'aménager pour recevoir des passagers voyageant en fauteuil roulant ou devant transférer sur l'un des sièges réguliers.

Cet autocar, de marque Ensign Emperor, dispose à l'arrière d'un compartiment propice à cet usage, l'accès pouvant se faire depuis la portière arrière grâce à des rampes mises en place et enlevées manuellement. Outre ce compartiment situé sur le pont inférieur, l'autocar dispose aussi d'un pont supérieur d'où les passagers ont une vue superbe grâce aux glaces surdimensionnées et, aussi, à la surélévation du pont. Quant au compartiment du pont inférieur, il peut contenir jusqu'à 12 passagers assis, jouissant eux aussi d'une vue magnifique grâce aux larges glaces latérales. Cet endroit a la faveur des passagers qui y trouvent une ambiance tant confortable qu'intimiste.

Cet autocar est fabriqué en Europe expressément pour la compagnie European Coach and Buss Inc. de Victoria, C.-B., qui en est le représentant des ventes. Pour le moment, il n'existe qu'un seul exemplaire de ce véhicule au Canada; mais les choses pourront bien changer à mesure que s'accroît la popularité de l'autocar à impériale, d'autant plus que le compartiment arrière, aisément adaptable et accessible grâce à des rampes, rend ce modèle particulier conforme au programme de recherche du CDT sur l'autocar grande capacité, à condition toutefois que sa faisabilité technique soit vérifiée.

Evolution du concept

Trois configurations ont été envisagées pour adapter le compartiment arrière au transport des passagers en fauteuil roulant. Option A, trois fauteuils tout à fait à l'arrière et dans le sens de la marche, plus deux leur faisant face, ancrés à la cloison séparant le compartiment de la soute; option B, deux places seulement réservées aux fauteuils roulants placés à reculons, les sièges devant être occupés soit par des passagers ordinaires, soit par des handicapés ayant transféré; option C, trois places tout au fond, dans le sens de la marche, réservées aux fauteuils roulants, les sièges étant occupés comme pour l'option B. Aux fins du programme de démonstration, l'option B a été choisie du fait que les places réservées aux fauteuils roulants sont sûres et commodes.

L'accès au compartiment s'est fait grâce à deux rampes à la fois légères, peu coûteuses et faciles à ranger. Il faut dire aussi que la hauteur du plancher par rapport au sol y a aidé, l'embarquement n'étant que de 430 mm, et moins s'il y a un trottoir.

Chaque fauteuil était ancré en place par quatre sangles fixées au sol dans des rails du type utilisé dans les avions pour régler la distance entre deux rangées de sièges, ces rails étant fixés à la cloison et au plancher.

Essais post-conversion

Les travaux d'aménagement ont été faits par la Western Bus Parts and Services Ltd. de North Vancouver, C.-B., les 17 et 18 février 1986; ils comprenaient:

- la fabrication des rampes et de leurs supports,
- l'enlèvement des sièges inutiles,
- la mise en place des rails de fixation, et
- la mise en place de huit sangles, quatre par fauteuil roulant.

Le 19 février, l'autocar adapté a été inspecté par les résidents et le personnel de deux hôpitaux pour personnes handicapées ainsi que par l'Association canadienne des paraplégiques. Toutes ces personnes ont examiné les aménagements et les ont essayés à leur goût, les volontaires étant recrutés parmi l'équipe d'étude ou des organisations de handicapés. L'accord a été unanime sur l'opportunité et l'utilité des aménagements. Note a été dûment prise des commentaires sur l'utilité de prévoir des dispositifs d'immobilisation Q-Straint, des appuie-têtes, des toilettes accessibles et un rembourrage de la portière. A part ces détails, tout a été trouvé conforme, de sorte qu'aucune modification supplémentaire n'a été nécessaire.

Les 20 et 21 février, les handicapés qui s'étaient portés volontaires ont mis les aménagements à l'épreuve. Au total, 22 handicapés ont été transportés vers divers lieux de Vancouver, et 16 d'entre eux ont suivi un itinéraire très sinueux et accidenté. Les volontaires ont été invités à remplir un questionnaire destiné à connaître leurs réactions.

Résultats des essais

Les essais ont mis en évidence les trois faits importants suivants:

- la distance entre les deux rampes d'accès était insuffisante dans quatre cas, y compris un cas où même la portière n'était pas assez large,
- des ceintures ventrales et des baudriers devraient être prévus en plus des dispositifs d'ancrage,
- la plupart des volontaires ont dit préférer transférer à un siège régulier plutôt que de voyager dans leur fauteuil.

Il est possible de répondre à la première exigence en élargissant les supports dans lesquels s'emboîtent les languettes articulées des rampes d'accès, de manière à rendre réglable la distance entre celles-ci. Cette recommandation a été retenue et sera mise en oeuvre ultérieurement. De même, la portière arrière de tout nouvel autocar adapté devra être élargie de quelque 150 mm.

La norme ACNOR CAN 3 - D409 - M84 prescrit l'utilisation de ceintures ventrales pour retenir une personne en fauteuil roulant. Certains transporteurs préfèrent que les passagers utilisent leur propre baudrier de type Velcro, tandis que d'autres fournissent des appuie-têtes portatifs du type que l'on fixe aux poignées des fauteuils. Toutefois, trois volontaires ont déclaré avoir souffert de l'absence d'un dispositif pour retenir le torse et se sont prononcés en faveur de la ceinture du type Q-Straint. En ce qui concerne les appuie-têtes, même si aucun commentaire n'a été reçu de la part des volontaires, le personnel hospitalier les a trouvés nécessaires et a suggéré ceux du type que l'on fixe aux bras des fauteuils.

Coût des aménagements

Les aménagements en vue d'adapter le compartiment arrière pour le transport de passagers en fauteuil roulant, mais qui transfèrent à un siège régulier, coûteront autour de 1 500 \$ si les travaux se font en usine; ces travaux comprendront des rampes d'accès et des mécanismes pour plier et écarter un siège double durant la montée et la descente des fauteuils roulants. Le service ainsi offert sera comparable à celui des compagnies aériennes qui offrent d'aider les personnes handicapées à transférer à un siège régulier.

Installer des rails au plancher et des dispositifs d'ancrage et d'immobilisation pour deux autres passagers demeurant dans leur fauteuil, coûtera moins de 3 000 \$, en tout.

Il faut comparer ces coûts avec les 330 000 \$ nécessaires pour acheter un autocar et avec les 2 000. \$ en équipement audio-visuel pour divertir les passagers. L'autocar se loue à raison de 800 à 1 000 \$ par jour, de sorte que le coût des aménagements est l'équivalent d'un maximum de trois jours de location. Ainsi, le transporteur qui envisage d'acheter un autocar Ensign Emperor pourra également envisager d'accroître son marché en rendant le véhicule accessible aux passagers en fauteuil roulant.

Comme les personnes qui ont examiné l'autocar l'ont trouvé très prometteur de leur point de vue, elles ont cherché à savoir s'il était possible de le prendre en location. Vu le nombre très important de passagers qui trouvent difficile, voire impossible, l'accès d'un autocar classique, il semblerait que les perspectives commerciales de l'autocar adapté soient bonnes.

Conclusions et recommandations

En conclusion, il est amplement justifiable de consentir les fonds nécessaires à l'adaptation du compartiment arrière d'un autocar à impériale, vu l'accroissement du marché qu'elle apporte au transporteur. Les rampes sont aisées à fabriquer et sécuritaires tandis que, du point de vue des passagers handicapés, le voyage pourra se faire en grand confort et sans le sentiment d'être isolé du reste des passagers. Quant à savoir s'il faut choisir entre laisser les passagers en fauteuil roulant voyager dans leur fauteuil ou les transférer à des sièges réguliers, et s'il faut oui ou non prévoir des toilettes, la décision appartient au transporteur. Ce qui est sûr c'est que l'adaptation du véhicule pour le transport des personnes en fauteuil roulant serait profitable aussi bien aux usagers qu'aux transporteurs.

Il est donc recommandé qu'un autocar, adapté comme il est indiqué dans le présent rapport, soit mis en service expérimental et que la réaction de tous les passagers soit dûment enregistrée, tout au long.

PRELIMINARY EVALUATION OF THE ACCESSIBILITY
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1. INTRODUCTION

This report documents preliminary investigations into methods of modifying the rear compartment of an existing, luxury, intercity motor coach for use by disabled passengers so that they may travel in wheelchairs or be transferred from wheelchairs to conventional seats for the journey.

This concept presents an opportunity to improve transportation services for disabled people by providing a more comfortable ride for trips involving greater distances and highway travel than can presently be offered by operators using a transit mini-bus (for the disabled). Disabled passengers are expected to benefit from the shared experience of social integration, touring with their able-bodied friends, relatives and co-passengers.

The concept, if successfully tested, could be incorporated in the advanced design high capacity bus (ADB) which has been researched by the Transportation Development Centre.

1.1 Background

European Coach & Bus Inc., of Victoria B.C., intends to market its motor coach, the Ensign Emperor, to tour operators who are interested in extending their charter services to include people with physical handicaps. The firm currently provides buses for charter tour companies operating within western Canada and the United States, particularly Vancouver Island. This new quality tour service for disabled people is to be offered in time for the peak summer tourism period and Expo 86. In addition, other coach operators may be interested in acquiring double-decked coaches easily accessible to wheelchairs, if the capability to serve disabled persons is seen as providing them with a wider market than is available with a coach of standard design.

A major feature of the existing tour service is travel in a luxurious motor coach with Vista Dome observation windows. Passengers riding in the main cabin are provided with a viewing range greater than available on conventional intercity buses due to the height of the main cabin deck, positioning passengers above the rooftops of adjacent automobiles and buses. The capacity of this cabin is 49 seats. The Ensign Emperor also contains a lower level cabin with separate entry at the rear of the vehicle. This section accommodates twelve seated passengers. Although the viewing range is more limited, through large side windows rather than a Vista Dome, the cabin retains its popularity with passengers due to its comfortable "intimate" atmosphere. This rear compartment is potentially suitable (through conversion) for accommodating disabled persons, with access by the rear passenger door using a manually positioned ramp.

1.2 Study Objectives

The objective of this study has been to investigate the technical and economic feasibility of modifying the rear compartment of an existing and proposed future double deck intercity motorcoaches to provide ready access and seating for persons in wheelchairs or assisted from their wheelchairs to conventional seats for the journey.

1.2.1 Technical Feasibility

The vehicle has to be suitable for operation by one bus driver and to be licensed to transport disabled passengers safely along public highways throughout North America at speeds of up to 100 km/h for periods of up to two hours between rest stops.

1.2.2 Economic Feasibility

The proposed system modifications have to be demonstrated to be feasible in terms of cost in order to ensure potential marketability to charter companies operating in a highly competitive industry.

1.2.3 Feasibility of Future Designs

The potential for modified but similar buses to be manufactured in future should be examined to produce recommendations for appropriate design considerations to be included.

1.3 Project Methodology

The successive steps of the project are described in the report below under chapter headings as follows:

Chapter 2: System Design

Technical journals, standards, user reports and manufacturers' literature were reviewed to determine the state of the art of motor vehicles for the transport of disabled people, and similarly for related mobility aids and securement/restraint equipment. Possible location for wheelchairs within the bus, methods of access and securement and other facilities for serving disabled passengers were reviewed against criteria and a system meeting the criteria was designed for test.

Chapter 3: Test of the Conversion

A 3-day long test and demonstration was organized utilizing volunteer participants of local interest groups. This involved the organization of volunteers with different types of mobility requirements, the preparation of two survey questionnaires, and the selection of demonstration routes and rendezvous points.

Following this initial preparation and planning, modifications to the coach were made and tested, first by the project team members and professional and technical staff at organizations for disabled persons and subsequently by semi-ambulatory and wheelchair-assisted volunteer participants.

Chapter 4: The Test Results

Conclusions were drawn from the test as to suitable system designs for incorporation in future in appropriate inter-city buses in day-to-day use.

Chapter 5: Market Acceptance

The market acceptance of such a system was reviewed in terms of costs and benefits for a coach operator and social considerations as they might affect passengers.

Chapter 6: Conclusions and Recommendations

Recommendations were made for further testing and implementation of the concept.

2. SYSTEM DESIGN

A system was designed for transferring disabled passengers in wheelchairs into the selected coach, securing the wheelchairs and restraining the passengers while in transit and supplying various passenger needs during travel. The various aspects of system design are discussed below as follows:

- Selection Criteria
- Wheelchair Location within the Bus
- Access to and from Bus
- Securement and Restraint within the Bus
- Facilities for Passengers During Travel

2.1 Selection Criteria

The system was designed to meet the requirements of:

- Canadian Standards Association: Motor Vehicles for the Transportation of Physically Disabled Persons
- Canadian Motor Vehicle Safety Standards.

Where standards do not exist, conventional practice was determined in discussions with operators and by reference to published articles. A bibliography is attached as Appendix A.

2.2 Wheelchair Location Within the Bus

The Ensign Emperor Coach is a double decked vehicle capable of transporting 49 seated passengers in its upper main cabin and 12 seated passengers in its lower rear cabin. Exhibit 1 shows the bus and Exhibit 2 presents a plan of its layout. Exhibit 3 lists relevant dimensions and specifications.

2.2.1 The Lower Cabin

The lower rear cabin lends itself to the handling of passengers in wheelchairs. The cabin has doors on each side of the compartment and the height of the floor from the ground is only 430 mm, permitting suitably designed ramp access. With the removal of seats as appropriate, the cabin can be designed to accommodate a mix of wheelchairs and standard seats.

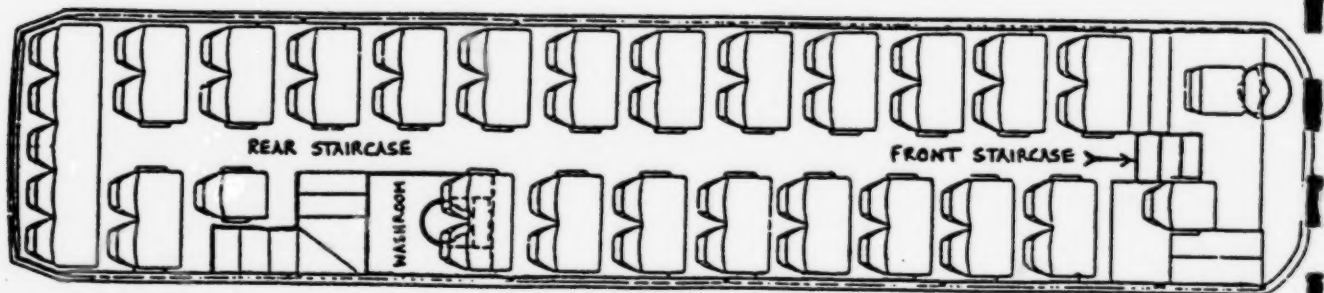
The existing layout seats twelve persons: five persons in the rear seat, four persons in two pairs of seats in the centre of the compartment and three who travel rear-facing in the front of the compartment. The significant features of the coach, as far as conversion for use by wheelchairs, are that:

- there are two doors, one on the curb side and one on the street side; the access on the curb side is obstructed by the bottom



EXHIBIT 1

THE ENSIGN EMPEROR COACH



UPPER DECK



LOWER DECK

EXHIBIT 2

PLAN OF COACH WITH STANDARD SEATING CONFIGURATION

EXHIBIT 3

Relevant Ensign Emperor Coach Specifications

Frame:	Volvo B10MT LHD Tandem	
Engine:	6 cylinder, 4 stroke, diesel	
GVW:	21,500 kg	
Max Speed:	126 km/h	
External Dimensions:	<u>European</u>	<u>North American</u>
Length:	12000 mm	12190 mm (40 feet)
Width:	2500 mm	2590 mm (8 feet 6 inches)
Height:	4000 mm	4120 mm (13 feet 6 inches)
Seats - Main Floor:	48 + 1 tour escort on folding seat at front	
Seats - Rear Cabin:	12	
Rear Cabin (Internal):	<u>European</u>	<u>North American</u>
Length:	2800 mm	2990 mm
Width:	2280 mm	2370 mm
Height:	1700 mm	1820 mm
Ground to Floor Height:	430 mm	

stair from the upper compartment, reducing the available width to 610 mm which is too narrow for almost all wheelchairs; the door on the road side has an available width with the door open of 660 mm which is below the CSA Standard of 690 mm but will handle many wheelchairs.

- there is a structural beam across the back of the bus which limits the extent to which wheelchairs can be pushed to the back of the coach. The existing seats located on this beam are reclinable, pushing the seat forward, which complicates the use of this space for wheelchairs.
- there is a strengthening brace which juts out under the middle of the three rear-facing seats.
- the existing model of the coach is not at maximum length or width allowed by North American regulations; its dimensions are 12000 mm x 2500mm; a stretched model 190 mm longer (40 feet) and 90 mm wider (8' 6") could be constructed.

Three options were identified which could be considered for testing:

- Option A with provision for 5 wheelchairs
- Option B with provision for 2 wheelchairs and 7 persons in regular seats
- Option C with provision for 3 wheelchairs and 3 persons in regular seats.

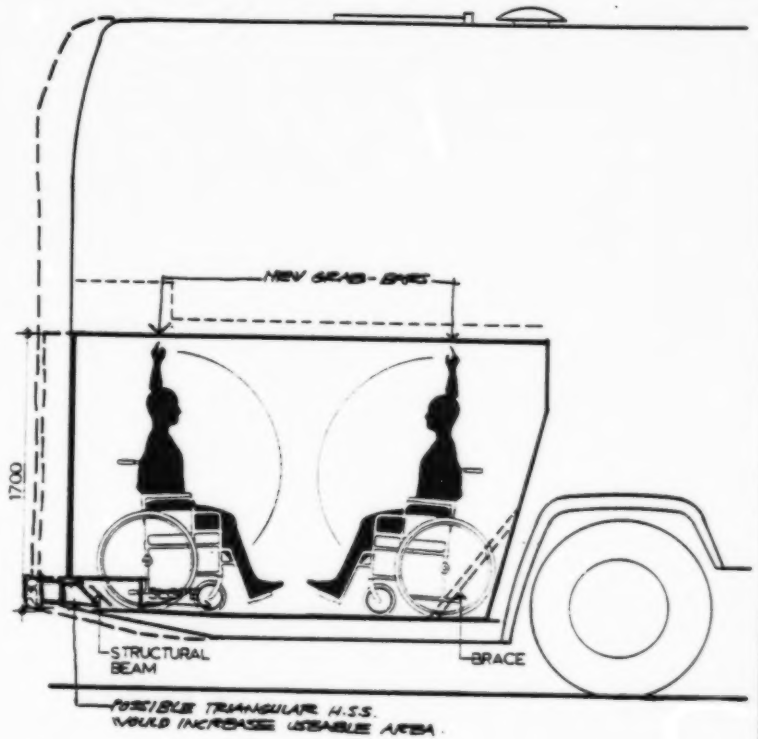
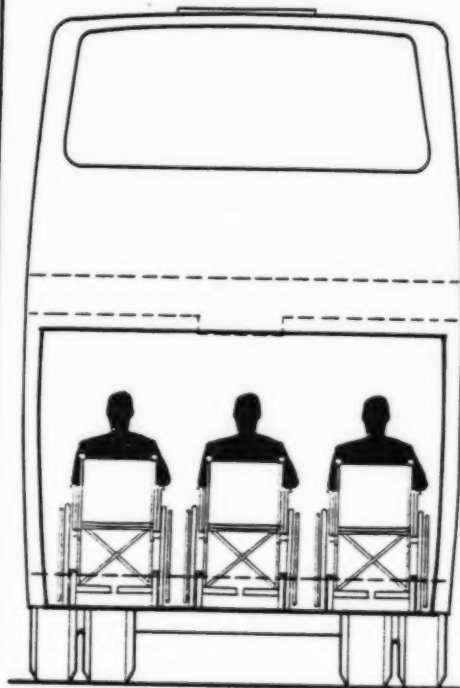
These are illustrated in Exhibits 4 to 6.

2.2.2 Option A

Option A was based on the principle of attempting to accommodate as many wheelchairs as possible. With the existing coach dimensions, loading of the last one or two chairs would be difficult due to inadequate turning room available. With the stretched version of the coach and a modification in the shape of the structural beam, this configuration could probably be used but circulation space would be limited. Moreover, there would be no room for an attendant (even though the five persons could be sufficiently disabled that they could not be helped from a wheelchair to a standard seat).

2.2.3 Option B

Option B provided for two chairs in a backward facing location at the front of the compartment. With the present location of the strengthening brace, this configuration accommodated one chair 660 mm wide and another 690 mm wide. The 660 mm is below the CAN3D409 M84 standard which requires a minimum area of 27" x 44" (690 x 1120 mm). In a modified coach, the refrigerator and the brace might be relocated to provide more space per chair (to meet the Canadian Standard) and to provide for easier maneuvering and securement. The heating boxes under the seats would also be relocated in a permanent modification.



SEATING CAPACITY = 5 DISABLED

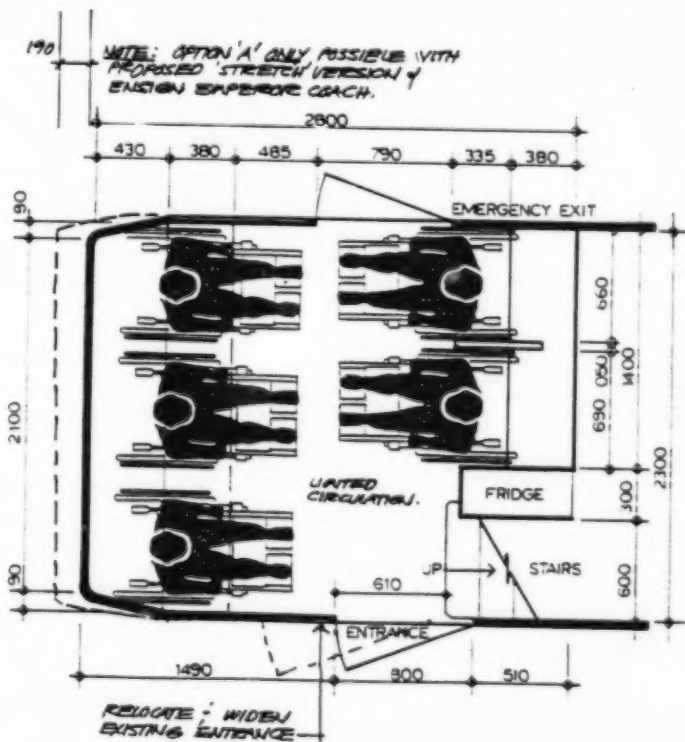
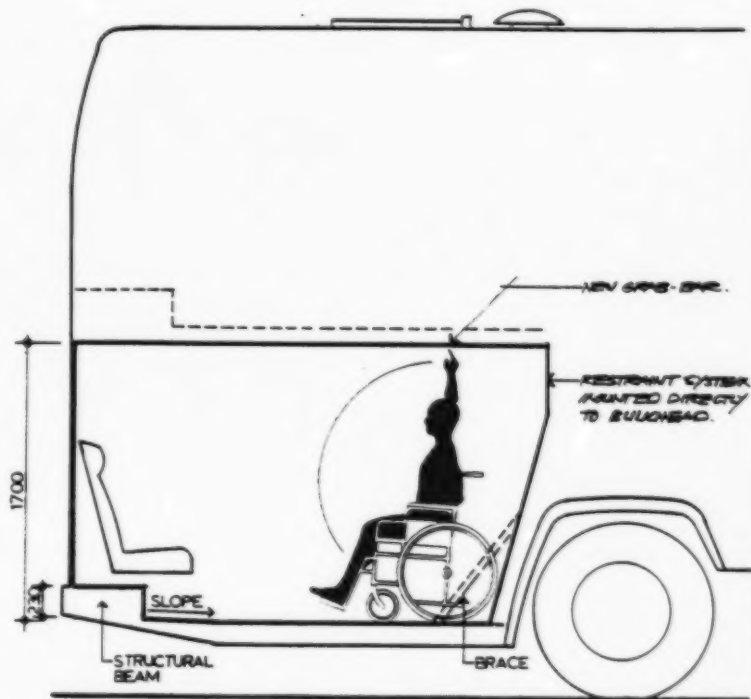
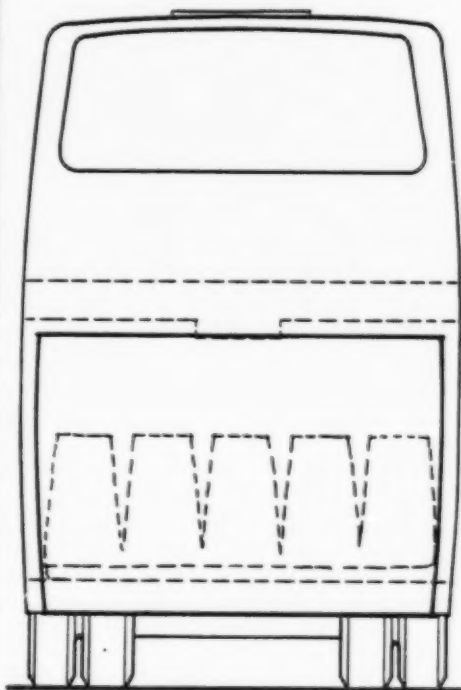


EXHIBIT 4
OPTION A

IBI
GROUP



SEATING CAPACITY: 7 + 2 DISABLED.

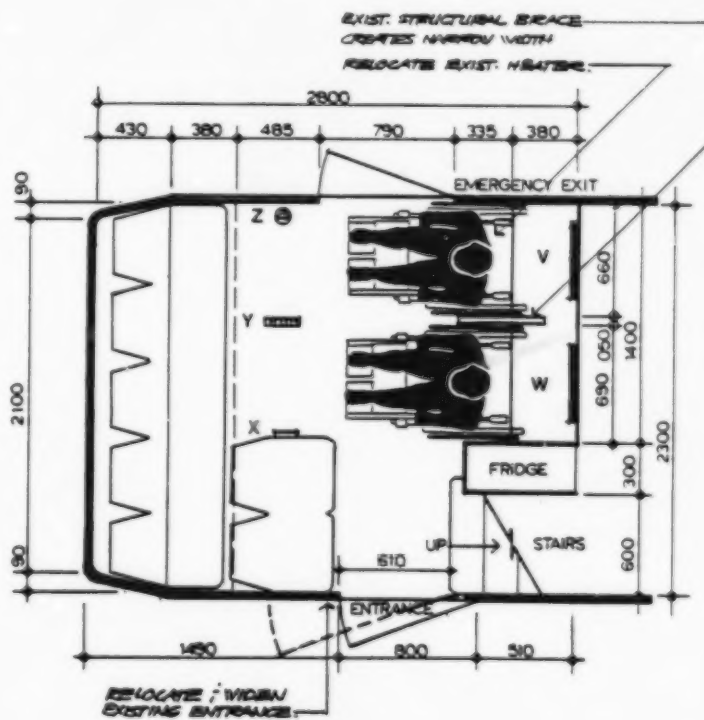
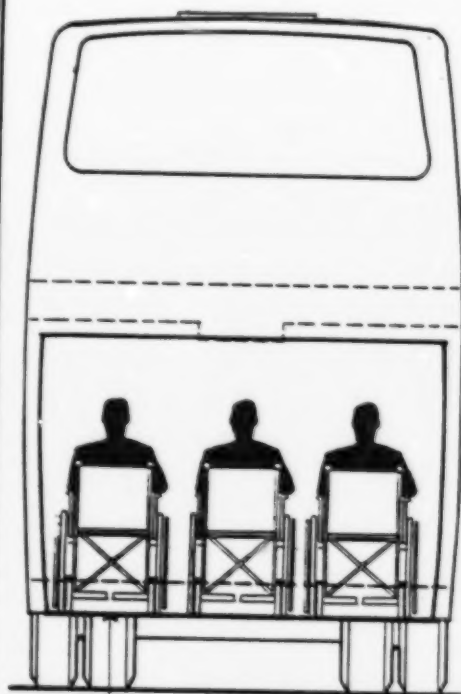
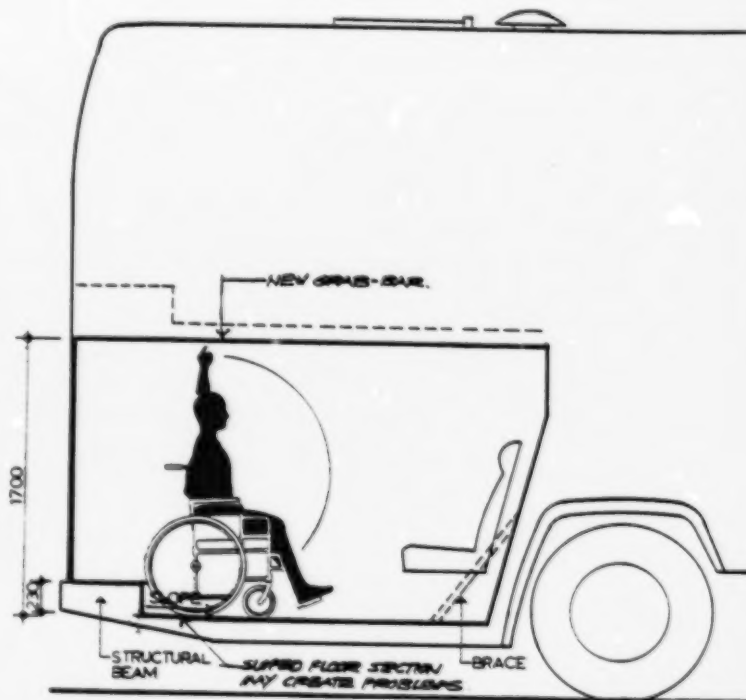


EXHIBIT 5
OPTION B

IBI
GROUP



ADAPTED WITH FOUR 3 WHEELCHAIRS -
ABILITY TO ACCOMMODATE OVERSIDE
CHAIRS.



SEATING CAPACITY - 3 + 3 DISABLED

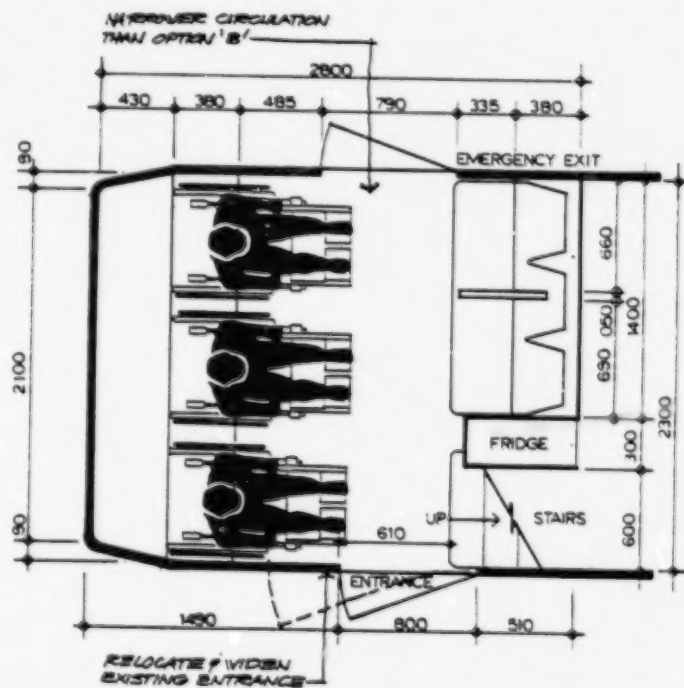


EXHIBIT 6
OPTION C

Seven standard seats remain available in this configuration. Initially it was thought that only the rear five seats would be available, but in testing it was found quite feasible to retain the two seats adjacent to the right hand door as well.

2.2.4 Option C

In Option C, three wheelchair positions of 700 mm width each could be provided at the rear of the coach facing forwards. Three standard seats were also available in this configuration.

2.2.5 Preferred Option

Of the alternatives, Option B was preferred as safest, with the passengers well protected in an alcove opposite the wheelwells and with chair backs to the front of the coach.

Option C was acceptable, but the passengers would be more vulnerable during a potential rear-end collision. Option A was considered unacceptable because of the limited circulation; in any event, it could not be tested with the existing coach.

2.3 Access to and from the Bus

2.3.1 Access Criteria

The method of wheelchair access into the motor coach was to meet these basic criteria:

- simplicity of operation
- safety
- comfort
- portability
- flexibility
- economy
- reliability
- rapid deployment

2.3.2 Preferred Access Method

A manually operated ramp was preferred in lieu of an automated lift for the following reasons:

- acceptable weight (for operation and stowage)
- when the rear cabin is being used for able bodied persons, the ramp can be stored remotely at the vehicle garage
- less costly to acquire and adapt
- fewer moving parts requiring less maintenance and training
- ramp is quickly and easily adjusted to various curb heights and wheelchair widths
- ramp appears secure to passengers as there are few moving parts
- passenger transfer is gradual and therefore comfortable
- the system is simple and has a functional appearance

The ramp system for the demonstration comprised two 2000 mm long structural aluminum rails or chutes, each having a flat base 133 mm wide containing sides at right angles 45 mm high (interior dimensions) (exterior dimensions 152 mm base with 51 mm sides). At one end, each rail had a single hinged tongue made of mild seamless steel boxed tubing. These tongues each interlocked into brackets welded beneath the cabin entrance floor on the road side of the coach. The ramps are shown in Exhibit 7, with the tongue engaged into the under-coach brackets.

The ramp length of 2000 mm compares with advertised ramps for vans which show lengths of 1500 to 2100 mm.

A ramp of 2000 mm provides slopes less than or equal to those found acceptable to established operators such as Vancouver Taxi. When there is no curb, the slope of the ramp is 1 in 4.7; with a conventional curb of 150mm, this slope reduces to 1 in 7.0. The CSA Standard D409 does not specify a standard for ramp slope. The British Code of Practice for the Carriage of Passengers in Wheelchairs on Public Service Vehicles recommends that the gradient should not exceed 20%, i.e. the ramp length should be at least 2150 mm on this criterion for this coach if loading does not take place from a curb.

The brackets were spaced to hold the ramps snugly while placing the ramps at the maximum spacing permitted by the door. When not in use, the ramps were stored in a baggage compartment; it would be convenient for the operator if a rack were provided in the baggage compartment roof to receive the ramps for storage in regular use.

2.4 Securement Within the Bus

2.4.1 Securement Criteria

There are over 135 different types of wheelchairs and scooters available on the market and the trend is increasingly to more models, particularly of electric wheelchairs with electronic controls suitable to each individual's requirements. Securement devices have to be adaptable to this wide variety of wheelchairs.

The criteria for securement devices were that they should:

- meet CMVSS 209 for belt system strength
- meet CMVSS 207 for anchorage strength
- conform with CSA Standard D409
- be simple to attach to the wheelchair and to a point on the vehicle
- be capable of restraining a wheelchair to movement of less than 10mm at speeds of up to 100km/h
- be adaptable to different sizes and placements of wheelchairs

2.4.2 Preferred Securement System

The preferred system was one consisting primarily of tracks with a series of slots, into which a push stud attachment of a belt system was

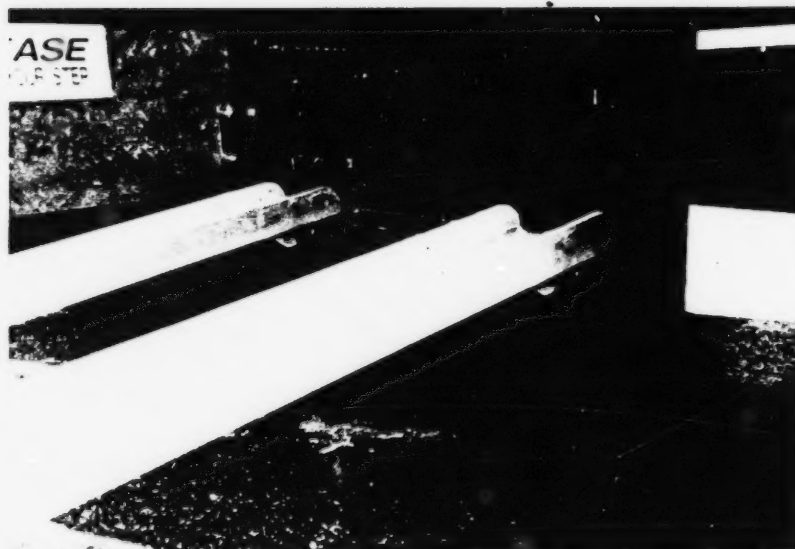
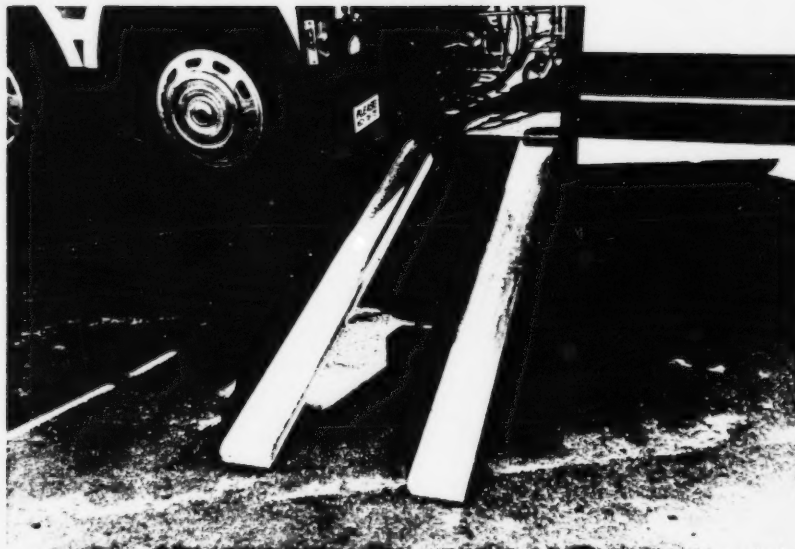


EXHIBIT 7
RAMP ACCESS TO COACH

pressed. The system is shown in Exhibit 8. It is a standard system and available off the shelf.

Two sections of track (V and W in Exhibit 5) were rigidly fastened through the front wall of the rear compartment to receive the attachments of four belts so that the wheelchairs could be held back to these tracks by two belts each, usually crossed. A steel channel section was welded to the coach behind this wall to provide adequate strength, since the bulkhead consisted of aluminum sheeting over fibreglass insulation. One length of track is shown in the top photo of Exhibit 8.

Three anchoring devices were provided forward of the wheelchairs. The right hand device was a section of track attached to a seat frame (at X in Exhibit 5) to receive the attachment of the forward right hand belt of the right hand wheel chair. It is shown anchoring one chair in the bottom photo of Exhibit 8. The central device received the forward attachments of both the left hand belt of the right hand wheelchair and also the right hand belt of the left hand wheelchair (see middle photo of Exhibit 8). It was rigidly fastened to a steel frame member of the chassis (Y in Exhibit 5). The left hand anchoring device (also in the middle photo of Exhibit 8) consisted of a folding ring set through the floor to receive a belt hook meeting CSA standards. It was similarly fastened to the chassis (Z in Exhibit 5). The hook and folding ring attachment was preferred because of the risk of any other device tripping individuals due to the close proximity to the door.

The rear belts which attached to the back wall were fitted with cinches to allow them to be attached to the wheelchair frames and then be cinched up. The front belts had clamping tensioning devices, so that the belts could be pulled to nearly taut and then be placed under tension by the clamping device which pulled over and locked into place. These devices are shown in Exhibit 9.

No system was used to restrain the passengers within the wheelchairs, to protect their heads in the event of a sudden stop from high speed (high speeds were not tested in the demonstration) or to provide hand holds for swaying motion. The omission for test purposes was to ascertain comments from the riders as to the need for such systems. The CSA Standard D409 requires an occupant restraint system consisting of at least a lap belt and some operators provide a Velcro-fastened belt which restrains the occupant in the wheelchair at about chest height. Portable headrests which attach to the handles of many wheelchairs may also be supplied by some operators. Grab bars do not appear to be a common facility provided. Comments on desirable additional restraints are made later in Chapter 4.

2.5 Facilities for Passengers During Travel

The Ensign Emperor Coach in its rear compartment provides:

- a video monitor, operated by the driver
- a public address system
- a telephone connected to the driver location
- thermostat control
- airline seating with head rests, folding armrests beverage trays and a reclining feature, with some having lap belts
- refrigerator

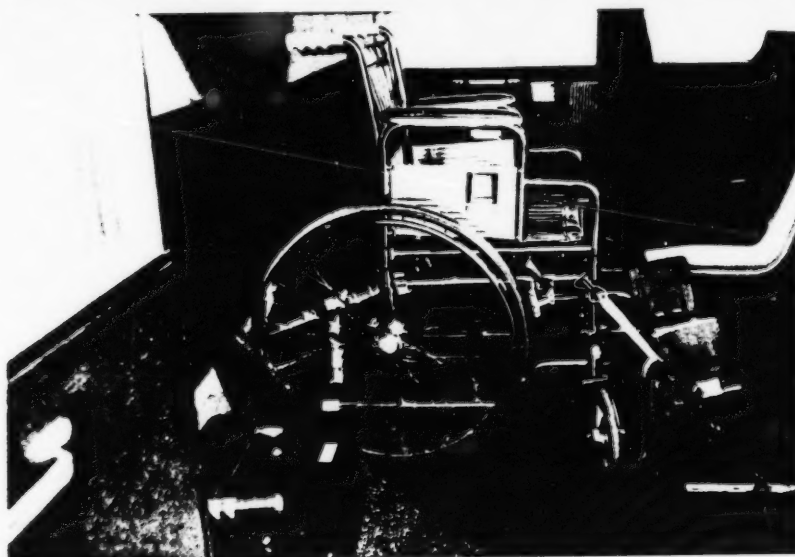
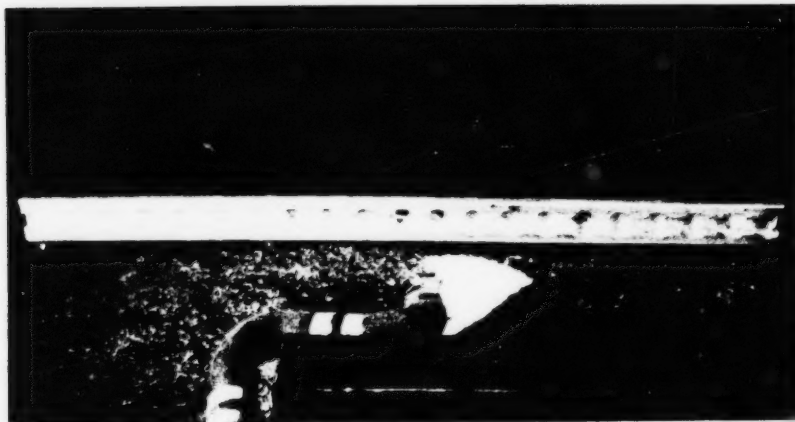


EXHIBIT 8

WHEELCHAIR SECUREMENT SYSTEM

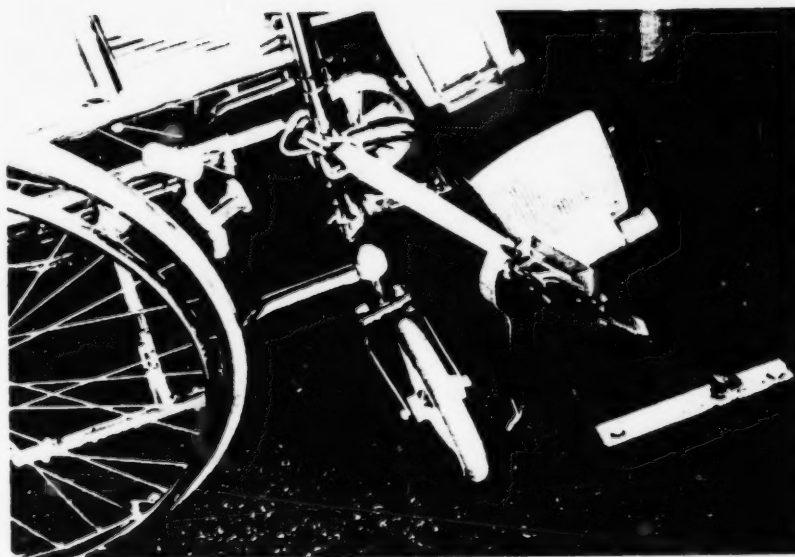
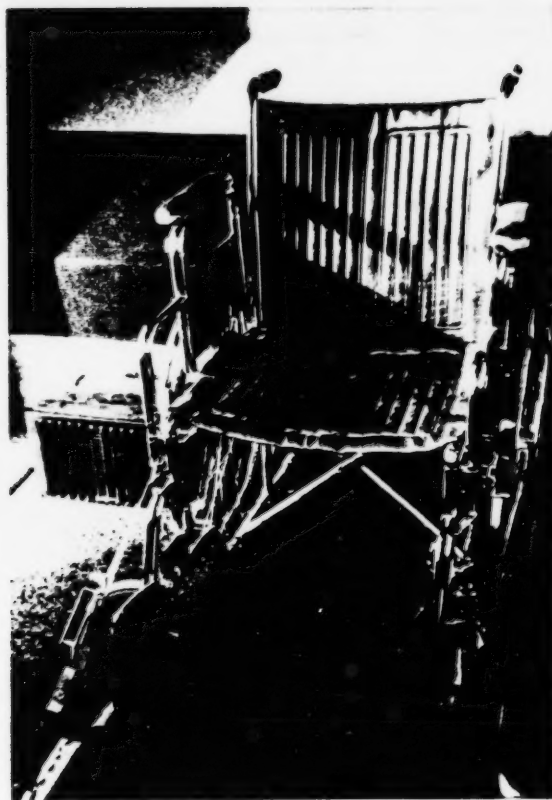


EXHIBIT 9

WHEELCHAIRS TIED DOWN

The coach has a washroom with access from a point halfway up to the stairs; this would not be accessible to a person who could not mount the stairs.

3. TEST OF THE CONVERSION

The test consisted of three parts:

- coach preparation
- system testing by the team and professionals
- system testing by disabled volunteers

3.1 Coach Preparation

The Ensign Emperor Coach was taken to Western Bus Parts and Service Ltd., in North Vancouver on Monday, February 17, 1986 and modifications were made to enable the coach to be used to test the concept described above. The layout tested was that of Option B; the two seats on the right hand side were not removed and were found to be very useable. The modifications took 1 1/2 days to make, being started at midday on the 17th and completed by the evening of the 18th. They consisted of:

- construction of the ramps and receiving brackets
- removal of the appropriate seats
- attachment of the tracks and floor ring
- provision of eight belt systems (four for each wheelchair position)

After modification, the space provided for wheelchairs was left with two heater boxes protruding up the floor. Such an arrangement would be unacceptable for a permanent arrangement, particularly since it would blow hot air over the legs of individuals who could have no feeling in their legs and could thus be burned. In a commercial system, the under-seat heater boxes would have to be replaced by a side heating system - an option which is available on new buses of this design.

3.2 Testing by the Team and by Professionals

On Wednesday, February 19, the bus was taken to:

- Pearson Hospital for the Disabled
- Canadian Paraplegic Association
- G.F. Strong Rehabilitation Centre

Individuals in these organizations (listed in Appendix B) reviewed the proposed arrangements, testing them as they considered appropriate, using members of the study team or volunteers from their organizations. All the staff were fully supportive of the concept and welcomed the potential of such a system. Nothing unsafe was found from these discussions and no further coach modification was made in the light of their comments.

However, the professionals and staff indicated improvements which they would recommend and these are included later together with passenger comments, which covers the same topics, in Chapter 4.

The professional emphasis was on:

- Q-strait restraint-system for passengers
- Head rests for whiplash protection in sudden stops
- Accessible washrooms in case of sickness
- Padding around doors to protect against involuntary hand movements when being wheeled through

3.3 Testing by Disabled Volunteers

3.3.1 Testing Schedule

Disabled volunteers tested the system in various locations in Greater Vancouver on Thursday, February 20 and Friday, February 21. The schedule is shown in Exhibit 10. A total of 22 disabled persons tested the system, of whom 16 were taken for a drive which included hills, sharp curves and modest but not sudden stops.

3.3.2 Use of Questionnaires

In order to identify any shortcomings or potential improvements within the proposed system, users were asked a series of questions from two pre-determined questionnaires (see Appendix C). Passengers, including project team members, wheelchair-bound volunteers and semi-ambulatory volunteers participating in the mock up trials were requested to respond to questions in Questionnaire I. Driver/Operators were to respond to Questionnaire II.

The purpose of administering the questionnaires was to obtain valuable user comments relating to the actual operational effectiveness of the proposed cabin modifications, ramp and restraint systems and associated passenger handling techniques. Also of interest was feedback on matters of a secondary nature relating to cabin environment (e.g. comfort, aesthetics).

3.3.3 The Sample

Project team members distributed questionnaires and surveyed users immediately following participation in the mock-up demonstration for the following reasons:

- opinions relating to comfort, feelings of security, etc., would be fresh in the mind of volunteer participant;
- project members could be readily available to assist if the meaning of particular questions was not immediately clear.

EXHIBIT 10

Schedule of Professional and Volunteer Tests

<u>DATE</u>	<u>TIME</u>	<u>ORGANIZATION</u>
<u>Professionals</u>		
Wed. February 19/86	1000	Pearson Hospital for the Disabled
	1300	Canadian Paraplegic Association
	1530	G.F. Strong Rehabilitation Centre
<u>Volunteers</u>		
Thurs. Feb. 20/86	1000	False Creek Residence for the Disabled
	1400	G.F. Strong Rehabilitation Centre
	1530	Steeves Manor for Senior Citizens
Fri. Feb. 21/86	1000	B.C. Coalition for the Disabled
	1400	False Creek Residence for the Disabled

It was planned that a minimum of twenty handicapped people, as well as project team members would participate in the demonstration and survey event over a period of two consecutive days. The population sample would include men and women of various ages, height, weight, intellectual ability, method of mobility and severity of disability. The aim of the sample was to span a range so as to identify any basic design shortcomings.

The following organizations were contacted to select volunteers:

- Canadian Paraplegic Association
- Pearson Hospital
- False Creek Residence for the Disabled
- Steeves Manor
- G.F. Strong Rehabilitation Centre
- Brock House
- B.C. Coalition for the Disabled

3.3.4 Testing Conditions

Weather conditions occurring during this time period included below average temperatures; snow, rain, wind and icing conditions. This resulted in certain difficulties for users as there was snow and ice build-up on sidewalks and low temperatures made loading less comfortable. Photography was hampered somewhat by overcast conditions.

Considering the weather conditions, the project team was pleased that the number of volunteers who did participate exceeded the target number of 20.

4. TEST RESULTS

This chapter first presents a statistical summary of the questionnaire results. It then presents comments on the concept under the same headings as in Chapter 2, i.e.

- Wheelchair location within the bus
- Access to and from the Bus
- Securement within the bus
- Facilities for Passengers During Travel

4.1 Questionnaire Analysis

Exhibit 11 summarizes the response of the passengers who tested the system. It will be noted that the sample was concentrated into the 20 to 35 year old age group, but the disabilities spanned a wide range (one person was on a stretcher) and so did the types of wheelchair. The comments on the various aspects of the system are discussed in the sections below.

The helpers found the system quite workable and their comments on desirable improvements are also included in the following sections.

4.2 Location Within the Bus

The location within the bus was generally popular. Visibility and the mixing with able-bodied passengers were appreciated. The only adverse comment by the persons was that inability to reach the main cabin gave a feeling of being a second-class citizen. There appears to be no way that this criticism can easily be met.

4.3 Access to and from the Bus

All but one of the passengers who were taken up the ramp or who propelled themselves up, found the method satisfactory and secure. However, the access could not accommodate four of the chairs for one of several reasons:

- the chair was wider than the distance between the flanges on the ramp
- the flange on the ramp hit the hand-held wheel and prevented the chair from being pushed
- the door was too narrow

These problems could be dealt with relatively straightforwardly in another modification. The brackets under the bus should be made wider so that the ramps can be placed at different spacings, thus overcoming the first two problems mentioned above. The door would have been wide enough

EXHIBIT 11

Summary of Passenger Questionnaire Responses

1. Your age is 0 19 1 1 1
under 20 20 - 35 36 - 50 51 - 65 65 + over
2. You are 10 or 12.
male female
3. Please check which of the following disabilities apply to you.
muscular dystrophy 3 residual polio 0
cerebral palsy 5 multiple sclerosis 1
arthritis 0 other 9 unknown 4
4. Which position did you ride in the bus?
Facing the driving direction 7 or backwards 11 N/A 4
D/A
5. How comfortable was the ride up the ramp and into the bus?
1 9 3 1 N/A 6
poor o.k. good excellent D/A 2
- If poor:
- Why did you not feel very comfortable? steep, fear of falling
- What could be done to make you feel more comfortable? lift,
longer ramp, wider ramp, solid ramp, better ramp
6. How secure did you feel riding up the ramp into the bus?
2 3 7 N/A 6
not secure somewhat secure very secure D/A 4
- Why did you not feel very secure?
- What could be done to make you feel secure? wider ramp and door,
trained assistance
7. How comfortable was the ride in the bus?
0 2 5 7 N/A 6
poor o.k. good excellent D/A 2

8. Did you feel secure supported by the restraint system?

0	3	6	N/A 8
not secure	somewhat secure	very secure	D/A 5

If not secure:

- How could this be improved: _____

9. How much movement did your chair make?

4	4	0	0	In Seat 5
none	a little	a fair amount	a great deal	N/A 2
				D/A 7

10. What type of movement did you experience?

back and forth	3	other 1 banking	D/A 19
side to side	3		
sliding around			
up and down			
vibration			

11. How acceptable to you was the appearance of the wheelchair restraint

1	6	4	D/A 11
poor	o.k.	good	

12. Any other comments or suggestions:

Better than Handidart Bus Add W/C, railings, food trays

Shoulder harnesses, step Door too narrow Pad doorway

Refrigerator is obstruction Means of getting to upper deck

Thank you for your cooperation.

Majority of users would prefer to be transferred to seat.

2 users felt they were 2nd class citizens at the "back of the bus".

N/A - Not applicable
Could not use system

D/A - Didn't answer

for all the wheelchairs if the strap restraint on the hinge had been removed to permit the door to open 180°, instead of being restrained to 90°. However, a more basic approach would be to widen the door to at least 690mm in accordance with the CSA Standard D409 and preferably by 150mm to allow an 810mm opening, with ample clearance for passenger arms and for electronic controls.

4.4 Securement Within the Bus

The wheelchair securement system was fully effective in all cases. However, there were difficulties in its use:

- attaching the straps to the second wheelchair was time-consuming given the relatively cramped conditions in which to work
- the restraints held the wheelchair but did not hold the passenger back and there were four comments of movement within the chair (three reporting back and forward plus side to side movement and one reporting banking round a corner).

However, nearly all the volunteers who could transfer said that in practice they would leave the wheelchair area in the compartment and would use one of the standard seats. By their nature, volunteers for the test may be expected to be biased in favour of being more mobile than the average disabled person. Nevertheless, this may also be true of the disabled traveller who would be attracted to a coach trip.

Suggestions for a future modification from this evaluation would be:

- install Q-Strait belts, with lap and shoulder harnesses
- equip at least some of the standard seats in the rear compartment with shoulder and lap belts.

Lap belts may be provided on all seats of the Ensign Emperor Coach, but there is no requirement for their use, even when passengers are in facing positions. However, it could be desirable to require passengers facing disabled passengers to use their seat belts, since the disabled person may have less means of protection (depending on the disability) if a passenger is thrown forward on to them.

4.5 Facilities for Passengers During Travel

The ride was classified as satisfactory by all the passengers and as excellent by half of them. Apart from the comments on the location, access, securement and restraint mentioned above, other comments were made as follows:

- need for washroom access - e.g. with assistance in the case of sickness
- would like food and beverage trays like the other passengers
- a padded door would protect the arms of the disabled as they are pushed through the doorway

The question of equality of treatment within the coach is raised here again. A preliminary design has been prepared of a rear compartment with a disabled passenger accessible washroom and is discussed in Section 5. On the other hand, some of the volunteers commented that although it is unequal, they had to travel journeys of four hours or more on some aircraft with no means of access to a washroom. The question of providing mobile food trays is relatively straightforward to resolve. Padded doorways would be a desirable additional feature.

4.6 Assessment by Driver/Operators

The driver and two operators who participated in operating the system and securing the wheelchairs used the Questionnaire II (see Appendix C) as a checklist and agreed on their assessment of the system from a driver's viewpoint as follows:

Removal of Ramp From Storage:	Straightforward; if there were a full load of baggage, it would be helpful to separate the ramp, e.g. in a storage rack
Positioning of Ramp:	Straightforward
Taking Wheelchair Up Ramp:	Straightforward for chairs that fitted; there was insufficient lateral adjustment of the ramps and the door was sometimes insufficiently wide; three - wheeled chairs could be tilted and backed up
Assistance of Semi-Ambulatory:	Simple; an improvement over a regular intercity bus, even without ramps
Maneuvering and Positioning:	Possible although restricted for space
Securing Wheelchair:	Relatively time consuming; the absence of a standard wheelchair slows the learning process; assisting from wheelchair to seat from aisle was easy
Releasing Wheelchair:	Easier than securement but could be cumbersome for some wheelchairs given the confined space
Taking Wheelchair Down Ramp:	Straight forward and gravity assisted when the chair was a tight fit in the ramps
Removal of Ramp to Storage:	Easy

The conclusion of the operators was that the ramp spacing should be more flexible; the problems of securement of many varieties of chairs in restricted space were seen as a fact-of-life with no easy remedy.

5. MARKET ACCEPTANCE

Coaches of the Ensign Emperor type, equipped to handle disabled passengers, can be expected to be produced if:

- the benefits to the operators exceed the costs
- there is a market of individuals who wish to make such trips

These questions are discussed below.

5.1 Benefits and Costs to Operators

The cost of the conversion made for this test was \$2,150, consisting of:

Ramps and Under-Coach Brackets	\$875
Safety Straps and Buckles	\$300
Track Fabrication and Installation	\$975

This cost is put in perspective by noting that the coach costs \$330,000 new and carries \$2,000 worth of TV equipment to show movies during travel. The rental cost of the coach is \$800 to \$1,000 a day, so that the amount a coach operator has to pay for the ramp and securement system option is less than his income from three days of bookings during the life of the coach.

Since there is only one Ensign Emperor double-decked coach in North America at this time, the basic issue is not the retrofitting of this particular coach but the cost of equipping future coaches in the factory when they are assembled. Hence, the cost of removing the heater boxes has not been itemized, since a side-mounted heating system would be used in a new bus at no extra cost. Similarly, a washroom at the rear corner of the coach would be no more expensive (and probably less expensive) than the present one accessed from the staircase. With suitably designed doors, the washroom entrance would offer some additional maneuvering room for wheelchairs during loading and unloading. The layout with a washroom is shown in Exhibit 12.

With a new bus with the washroom in the present location, it is proposed that the two seats adjacent to the door be made collapsible to create enough space for wheelchair maneuvering, after which they would be restored for passengers - either able bodied or wheelchair assisted. It is estimated that the additional cost for this provision would be \$300. Padding the door could cost an additional \$200.

In a wheelchair-carrying configuration, the two seats facing the wheelchairs would be sufficiently spaced in the larger model of the bus to be suitable for the attendants, although the spacing might be considered inadequate for strangers.

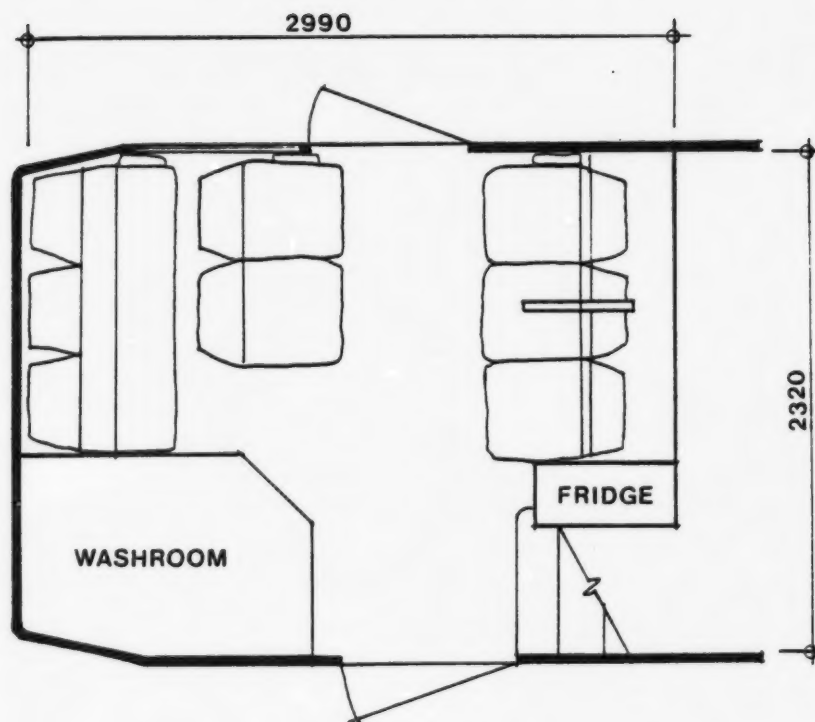


EXHIBIT 12

REAR CABIN LAYOUT WITH WASHROOM

The operator would therefore lose revenue seats only when the wheelchair passengers were sufficiently disabled that they could not transfer to regular seats, but they had no accompanying attendants and it was considered that other passengers would not wish to face the disabled passengers.

Exhibit 13 shows the conversion cost and seating capacity of a bus with or without the washroom moved to the rear and with either wheelchair-assisted or full wheelchair-carrying capability. The cost differences are relatively insignificant. Moving the washroom into the rear compartment loses four seats there, but gains two upstairs from where the present facility is.

With seats collapsible or replaceable, there is no loss of capacity when handling wheelchair-assisted passengers, but there is a loss of one seat in wheelchair-carrying service because only two wheelchairs are carried where three able-bodied persons would sit.

In services between urban centres, where the interval between stops is always less than 1 1/2 hours, an operator may prefer the version with the washroom in its present location, to maximize his seating capacity. Moreover, the rear cabin would be roomier and more attractive without the washroom. However, in longer-haul applications, the advantage of a washroom may be greater than the reduced attractiveness of the cabin and the loss of two seats, because it offers a desirable service to the disabled passenger and reduces the frequency of stopping.

The additional cost to have the facility to carry passengers remaining in their wheelchairs through the trip is small, and appears to be worthwhile to most operators in case it could ever be useful.

Subject to contrary indications from any further market analysis, we have not considered further options, such as those of Option A in Exhibit 4 of this report which provide more than two wheelchair spaces. It appears likely that the great majority of potential customers will wish to transfer to regular seats and not ride in a wheelchair. Airplanes do not carry persons travelling in wheelchairs, although the securement system used in this test could readily work on aircraft seat retaining tracks.

5.2 The Market

The literature indicates that there is a large potential market of disabled passengers for intercity travel. About 10% of Canadians are disabled to the extent that they would be unable, or would have difficulty trying to mount the set of stairs into a standard inter-city bus (e.g. for reasons of arthritis or heart conditions as well as restriction to a wheelchair). What proportion of these people would be attracted to the converted Ensign Emperor is not known, nor was it within the terms of reference of this study to find out.

However, it is worth noting that the volunteer groups were impressed with the potential of the coach and inquired about renting it. The tour organizer at Steeves Manor, an apartment complex for senior citizens, said

EXHIBIT 13

Conversion Costs and Seating Capacity in New Bus

	NUMBER OF SEATS						
	Cost \$	WASHROOM IN PRESENT LOCATION			WASHROOM AT REAR OF BUS		
		Standard Config- uration	Wheel Chair Assisted Only	With Wheel Chairs	Standard Config- uration	Wheel Chair Assisted Only	With Wheel Chairs
No Additions	0	61	—	—	59	—	—
Ramp System Only for Wheelchair Assisted *	1400	61	61	—	59	59	—
Ramp System plus Full Wheelchair Capability *	2650	61	61	60	59	59	58

* Costs and capacity assume two seats made collapsible or removable to allow wheelchair maneuvering.

she organizes day trips and has to leave some individuals at home because they cannot manage the stairs. Although not designed as representative of the total market the comments from the participating organizations confirm the estimate from other research that there is a market for vehicles equipped to handle individuals in wheelchairs. Moreover, it appears to be economic to an operator without a subsidy (unless the excess cost of an Ensign Emperor Coach in standard configuration over a standard North American design is considered worthy of subsidy to promote the disabled transport option).

6. CONCLUSIONS AND RECOMMENDATIONS

The concept of converting the lower rear cabin of a double-decked bus (such as an Ensign Emperor Coach) with ramps to be able to handle passengers in wheelchairs is feasible and can be accomplished for between \$1,500 and \$3,000. The ramps are simple and safe to use. The system permits groups including both able-bodied and disabled persons to charter bus trips for their members. In scheduled service, in a coach load of 60 persons in total, it permits an operator to carry up to eleven passengers assisted from their wheelchairs to conventional seats. The passenger is provided with a comfortable ride with a mixture of disabled/able-bodied individuals. Depending on the nature of his business, an operator could choose whether to provide for:

- wheelchair assisted passengers only or also for those who wish to travel in their wheelchair
- a wheelchair accessible washroom in the rear compartment

However the case for providing for wheelchair passengers in some form is strong and clearly in the interests of the passengers and the operator.

The next recommended stage is a demonstration in operation in revenue service. The objective of such a demonstration would be to prove the market for such a service and to measure how many passengers of various types would use it. It would have to run for a period of at least six months to allow time for word of the demonstration to be spread and for disabled persons to start to plan inter-city trips through its use.

There appear to be three options:

- have the coach operated by a tour operator who would charter it for trips by various groups
- lease the coach to an operator with an existing scheduled service and compare the change in patronage
- attempt to license the coach for an inter-city route and measure its acceptance

The first option would indicate the extent to which there is a demand for chartered service by groups which include a proportion of disabled persons. Such groups would include senior citizens' organizations, the Canadian Legion, service clubs, church groups and other associations, some but not all of whose members might use wheelchairs.

The second and third options of demonstrating scheduled service would show the potential of the system for regular inter-city use. It would be necessary to identify an operator who would be interested in using the Ensign Emperor luxury coach on his present inter-city runs, or on runs for which he might obtain a permanent or temporary licence, e.g. Vancouver-Victoria during the Expo months.

APPENDIX A

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APPENDIX B

PROFESSIONALS CONTACTED

APPENDIX B

Professionals Contacted

Pearson Hospital
for the Disabled

Ms. W. Fraser
Mr. R. Haynes
Mr. R. Easterbrook

Canadian Paraplegic
Association

Ms. G. Endo
Mr. W. Moser

G.F. Strong
Rehabilitation Centre

Mr. C. Grierson
Mr. W. Williamson
Ms. J. Hunter
Mr. S. Lloyd

APPENDIX C

QUESTIONNAIRES

APPENDIX C

QUESTIONNAIRE #1

1. Your age is under 20 20 - 35 36 - 50 51 - 65 65 + over
2. You are male or female.
3. Please check which of the following disabilities apply to you.
muscular dystrophy _____ residual polio _____
cerebral palsy _____ multiple sclerosis _____
arthritis _____ other _____
4. Which position did you ride in the bus?
Facing the driving direction _____ or backwards _____
5. How comfortable was the ride up the ramp and into the bus?
poor o.k. good excellent
If poor:
- Why did you not feel very comfortable? _____
- What could be done to make you feel more comfortable? _____

6. How secure did you feel riding up the ramp into the bus?
not secure somewhat secure very secure
- Why did you not feel very secure? _____
- What could be done to make you feel secure? _____

7. How comfortable was the ride in the bus?
poor o.k. good excellent

8. Did you feel secure supported by the restraint system?

not secure somewhat secure very secure

If not secure:

- How could this be improved: _____

9. How much movement did your chair make?

none a little a fair amount a great deal

10. What type of movement did you experience?

back and forth _____ other _____
side to side _____
sliding around _____
up and down _____
vibration _____

11. How acceptable to you was the appearance of the wheelchair restraint

poor o.k. good

12. Any other comments or suggestions:

Thank you for your cooperation.

CAI
 12801
 86
 P608
 C.2
 (MM)

QUESTIONNAIRE #2

Driver/Operator

T A S K	IN- ADEQUATE	ADEQUATE	COMMENTS
1. Removal of ramp from storage			
2. Positioning of ramp, relative to curb height and securement			
3. Backing of wheelchair up ramp			
4. Or Assistance of semi-ambulatory into Bus			
5. Maneuvering of passengers (and wheel-chairs) in aisle to seats/locations			
6. Positioning wheelchair within restraint system			
7. Positioning of footrest(s), handrests(s), etc.			
8. Secure wheelchair restraint system			
9. Secure passenger restraint system			
10. Release passenger restraint system			
11. Release wheelchair restraint system			
12. Removal of passengers from bus down ramp			
13. Removal of ramp			

ADDITIONAL COMMENTS

